Kenai Peninsula has its ups and downs

by Ed Berg

The Kenai Peninsula is a dynamic landscape in the quite literal sense of moving up and down. Like the stock market, the Peninsula is constantly on the move, but whether you say it's going up or down depends on your time scale of reference. The stock market has generally risen since 1929, but it has had down periods, such as the last twelve months. But even within the down periods the stock market has rising days and months, all of which makes stock market analysts perpetually argue about whether the market is really going up or down.

On the geologic time scale, the steep sea cliffs on the south side of Kachemak Bay and the southern tip of the Kenai Peninsula indicate that the coast has generally risen over the last 2-3 million years. This rise is typical of the west coast of North America; it contrasts with the generally subsiding east coast with its long shore bars, spits, and sand-clogged embayments, such as one sees along the coast of the Carolinas and Georgia. On a much shorter time scale, say, the 16,000 years since the last glacial maximum, the mouth of the Kenai River appears to have risen at least 440 feet and possibly much more. Most of this uplift is elastic rebound from the unloading of the glacial icesheet; the weight of the ice depresses the crust of the Earth, and the crust rebounds when an icesheet melts. An additional component of uplift could be added by the subducting Pacific tectonic plate, which is being pulled under the Kenai Peninsula and generates many of our earthquakes.

Even within a generally rising land surface, there can be "fast spots." The Swanson River oilfield for example lies within a very distinct oxbow of the Swanson River. When you fly over the main oilfield, you can see a long shallow lake and wetland (Hungry Lake) across the neck of the oxbow on the northwest side. This is the original river channel, before the river bulged out to the southeast. The layered bedrock has bowed upward (in an "anticline," as the geologists say) under the oilfield to form a domed trap for the oil. This upward bowing has continued since the icesheet retreated and has forced the river to cut a new channel around the southeast side of the uplift. (There are geologists who are paid big bucks to sit all day looking at aerial photos to pick out just this kind of clue to a potential oil-bearing structure.)

On a timescale of hundreds of years the Kenai Peninsula has suffered a number of downward jerks, like singular bad days on the stock market. The most recent bad day was March 27, 1964 with the Great Alaska Earthquake. In a matter of seconds the Kenai Lowland dropped as much as two feet. Areas with thick sand and gravel deposits, such as Cook Inlet beaches, experienced additional compaction (like shaken sand in a coffee can) which further lowered the ground surface. The tip of the Homer Spit dropped about five feet, with two feet due to tectonic lowering of the bedrock and three feet due to compaction of the 300 feet of sand and gravel underlying the Spit.

Like a recovering stock market, the Kenai Peninsula has been rising since 1964, but some areas are rising faster than others are. The area north of Skilak Lake, for example, is the fastest spot, having risen about 90 centimeters (three feet) since 1964, according to benchmarks along the Sterling Highway. The head of Kachemak Bay is the second fastest spot, with a 60-centimeter (two-foot) rise in this time period.

It appears that the Kenai Peninsula has experienced six to nine of these dive and rebounds in the last 5000 years, due to slippage along the underlying subduction zone. Rod Combellick with the Alaska Division of Geological and Geophysical Surveys studied ancient peat layers in a well core in Portage Flats in Turnagain Arm and at other sites around Cook Inlet. He noticed that after the 1964 subsidence, mud and sand were deposited on top of the marsh vegetation around Turnagain Arm, and that a new marsh began to grow on this recent layer of tidal sediments. He reasoned that in time the new marsh vegetation would form a peat layer, which could be buried in a future subsidence event. In the well core he observed periodic thin peat layers sandwiched between thick layers of tidal mud and sand. Using radiocarbon dating of the peat layers, he found an average interval of 600-800 years between peat layers, and inferred that this must represent the timing of very large earthquakes (greater than magnitude eight) in southern Alaska. (Unfortunately, the peat layers were not evenly spaced; some

occurred within a few decades of each other. One thus can't conclude that the next 1964-size earthquake won't happen for 600-800 years, so don't cancel your earthquake insurance!)

In Combellick's well the peat layers get older as you go deeper in the well. Does this mean that the land has been going down, at least for the 5000 years recorded in the well? No, it does not, because sea level has risen steadily by 120 meters (390 feet) since the last glacial maximum 16,000 years ago. If there hadn't been any earthquake-generated subsidence events, the peat would have grown thicker and thicker as sea level rose. Each mud- and sand-covered peat layer indicates a local "rise" of the sea level and flooding of the marshes. But sea level doesn't rise or fall locally (except for the tide), because the oceans of the world rise and fall together. So, a local flooding of the marshes and burial of the vegetation must mean that the land surface itself suddenly dropped, as it did dramatically in 1964.

It is hard to imagine a better geological laboratory than the Kenai Peninsula. I have been privileged to teach my "Geology of Kachemak Bay" course for many years at the Kenai Peninsula College in Homer, and more recently in Soldotna. This is a 1-credit class with five evening classes and two Saturday field trips to Kachemak Bay. The class starts next Tuesday (March 27) at the Soldotna campus and Friday (March 30) at the Homer campus. Call the College for registration information (262-0300 or 235-7743).

Ed Berg has been the ecologist at the Kenai National Wildlife Refuge since 1993. For more information about the Refuge, visit the headquarters on Ski Hill Road in Soldotna, call 262-7021 or see the website at http://www.fws.gov/refuge/kenai/.